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Macroeconomic trends and practice models impacting acute care surgery

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ABSTRACT

Acute care surgery (ACS) diagnoses are responsible for approximately a quarter of the costs of inpatient care in the US government, and individuals will be responsible for a larger share of the costs of this healthcare as the population ages. ACS as a specialty thus has the opportunity to meet a significant healthcare need, and by optimizing care delivery models do so in a way that improves both quality and value. ACS practice models that have maintained or added emergency general surgery (EGS) and even elective surgery have realized more operative case volume and surgeon satisfaction. However, vulnerabilities exist in the ACS model. Payer mix in a practice varies by geography and distribution of EGS, trauma, critical care, and elective surgery. Critical care codes constitute approximately 25% of all billing by acute care surgeons, so even small changes in reimbursement in critical care can have significant impact on professional revenue. Staffing an ACS practice can be challenging depending on reimbursement and due to uneven geographic distribution of available surgeons. Empowered by an understanding of economics, using team-oriented leadership inherent to trauma surgeons, and in partnership with healthcare organizations and regulatory bodies, ACS surgeons are positioned to significantly influence the future of healthcare in the USA.

INTRODUCTION

Trauma, emergency general surgery (EGS), and surgical critical care represent the breadth of expertise connoted by the term acute care surgery (ACS). Although the ACS concept evolved from the practice of academic trauma surgeons, ACS as a specialty is relatively new. The aim of this review is to provide the economic context for the maturation of ACS as a specialty focusing on the continuum from the macroeconomic to microeconomic, that is, from the level of the USA as a whole to individual institutions, to surgeons. Herein we define the changing healthcare landscape in which ACS exists and in which ACS must continue to thrive, including economic considerations specific to the ACS model of practice. We then review how various reimbursement models may impact ACS practices.

Macroeconomic trends impacting ACS

Key concepts

- ACS-related conditions constitute as much as 20% to 30% of all inpatient hospital costs in the USA.
- The aging population has significantly changed the demographics of the population ACS serves—approximately 30% of all trauma-related expenditures are due to injuries in the elderly.
- Shifts in payments toward government and household payers are likely to contribute to further reshaping of the economic landscape for ACS in the future.

The economics of the practice of ACS is tethered to the country's overall healthcare economic landscape. National health expenditures per capita have grown steadily since the 1960s, amounting to $3.3 trillion in 2016. Given a projected growth rate of 5.5% per year, these expenditures are projected to reach $5.7 trillion by 2026.[1] Healthcare costs have been borne by the government (45%) and households (28%), with commercial payers accounting for 20%. However, as costs have continued to rise, financial risk has shifted further to households as employers have found it difficult to respond to increased healthcare costs. Premiums per household increased by 55% in 2017 compared with 2007,[2] outpacing wage increases. Between 2005 and 2017, wages increased 18%, whereas workers' contributions to premiums increased by 47%.[3] As a result, personal healthcare expenditures are overall projected to increase 63% between 2017 and 2026.[1] The burden of healthcare costs borne by the US government has prompted policy changes and legislation aimed at controlling these costs. So as private and government payers scale back what they are willing to pay, and households reach their limits, reductions in healthcare reimbursement can be expected across the industry.

The threat of reduced reimbursement has spawned industry-wide shifts in how hospitals and hospital systems function across the USA, particularly because hospitals have narrow (or negative) financial margins. In fact, not-for-profit health systems were issued a "negative" credit outlook by Moody's between 2008 and 2014. Hospital systems have responded to these pressures through a wave of consolidation. Both the rate and size of mergers have increased during the past decade. The average deal size for hospital acquisitions was $42 million in 2007; in 2013, it had increased to $224 million.[4] Consolidation allows for improved access to capital and ability to invest. Furthermore, as new reimbursement models emerge from payers such as Medicare, hospital systems must find capital to innovate around new care delivery models to remain viable. These changes can be felt at the local

level, as hospital administrators increasingly engage providers in ways to reduce costs at their hospital.

Unfortunately, although consolidation may provide new opportunities for health systems, it could lead to further increases in healthcare costs. When consolidation occurs in other industries, it is usually accompanied by a rise in prices.

Within this changing landscape lies ACS. Acute care surgical conditions account for a large portion of care delivered to hospitalized adults in the USA, as well as a large proportion of the costs, and this rate is increasing. In 2001, the number of admissions for EGS conditions alone was 2.4 million and steadily increased to over 3.0 million by 2010.[5] Trauma admissions are similarly common, accounting for an additional two to three million hospital admissions per year.[6] This means that ACS conditions together account for five to six million hospital admissions in the USA per year, translating into $65 to $100 billion ($28 billion for EGS + $37–$80 billion for trauma) for direct medical care.[7 8] Aggregate hospital costs for all hospital stays in the USA totaled $381 billion in 2013. ACS conditions constitute almost 20% to 30% of all inpatient hospital costs, which is likely underestimated. For trauma alone, it has been estimated that almost 9 to 10 times that amount (almost $700 billion per year) is lost when taking into consideration both healthcare costs *and* lost productivity.[9] High inpatient costs for ACS are due in part to the acuity and severity of ACS conditions. Fakhry *et al*[10] evaluated the proportion of costs for ACS patients due to critical care at a single level I trauma center. They found that the 31% of trauma and EGS patients who required intensive care unit (ICU) care were responsible for 70% of the total hospital costs for the ACS population.[10] They also found 7% of the ACS population requiring an ICU stay longer than 10 days to be associated with over 40% of the total hospital costs.

Taken together, the significant economic "footprint" of ACS conditions in the USA suggests that acute care surgeons are positioned to affect and be affected by the changing landscape of healthcare reimbursement. However, this vulnerability also implies ACS providers are in a position to lead change.

Economics of ACS models

Key concepts

- ACS as a specialty has evolved from unmet healthcare and professional need.
- ACS models of care reduce costs and improve outcomes.
- An ACS model increases the number of operative cases compared with trauma alone.
- Critical care codes constitute approximately 25% of overall productivity for acute care surgeons.
- The contribution of elective surgery to ACS productivity varies among organizations.
- Reimbursement for ACS will vary depending on the amount of EGS in the practice, demographics, and payer mix.
- There is a national shortage of general surgeons that is unevenly distributed with respect to population.
- ACS reimbursement affects the ability to achieve adequate staffing.
- New ACS specialty training programs are being developed to address unmet population needs.

The ACS model of care: benefits for patient outcomes and hospital financial performance

As elective patient care has shifted whenever possible to the outpatient setting to reduce costs, the acuity of inpatients has increased. This has occurred while demands for improved clinical efficiency and quality improvement by government payers and others have simultaneously increased. Surgeons are increasingly pressured to maximize productivity to maintain reimbursement. As a result, there is now increased attention to the economic viability of surgical practice models in the USA.[11]

Surgical specialties contribute positively to the hospital margin, and therefore to hospitals' overall financial stability. As surgical specialty cases are most often elective, length of stay and expenses can largely be anticipated and managed. In contrast, an ACS service involves non-elective cases and a higher proportion of uninsured. As a result, an ACS service evaluated on the surface might not appear to be financially profitable.[12] Sweeting *et al*[13] noted that after the creation of a mature ACS service, operative volume for the service increased, but the relative value unit (RVU) per case decreased, resulting in a lesser increase in overall RVU. The authors calculated that the loss of clinical income due to lower RVU procedures and a worsening payer mix meant that salaries could not be supported solely on clinical revenue generation and that fixed support would need to be augmented by about 28% to remain revenue-neutral.[14] Therefore, when using an RVU-based model to valuation, hospital-based financial support and resources would be necessary to implement and maintain a rigorous ACS model.

However, a deeper analysis reveals how ACS contributes to the financial profitability and viability of a hospital, particularly those that have active surgical specialty practices. The creation of an ACS care practice has been shown to improve hospital contribution margin, patient throughput, and complication rates.[13 15–17] This observation remains even when considering patients with a high severity of illness. For these patients, a mature ACS service reduces time from admission to surgery, mortality, and hospital lengths of stay.[18] Because delays in care are associated with increased mortality, longer lengths of stay, and higher total costs, an ACS service favorably impacts healthcare organization performance.[19] Standardization of practice for ACS conditions using evidence-based practice management guidelines also decreases hospital costs.[15]

Finally, utilization of an ACS model allows for improved efficiency of specialty surgical services as the work of taking call is off-loaded from high revenue-generating surgeons. Productivity among elective surgeons may increase after implementation of a surgical hospitalist program.[20] A surgical hospitalist program was found to save one organization an estimated $2 million annually. Despite the proven benefits to patients and costs, an ACS model is at risk of being undervalued by hospitals and departments if value is focused only on RVUs.

The relative economic roles and interdependency of EGS, trauma, and surgical critical care

ACS and hospital reimbursement

Regardless of its relationship to other hospital services, the financial viability of an ACS model is dependent on the relative contributions of EGS, trauma, critical care services, and elective practice. This is particularly true because the practice of trauma has changed in the last decade to involve less major operative and elective surgery and relatively more minor procedures and non-procedural revenue. In a pure RVU-based, primarily procedural practice based on fee-for-service, reimbursement for ACS surgeons suffers. In 2005, when ACS as a discipline was mostly conceptual, a study at the University of Louisville examined the financial viability of ACS by reporting charges, payments, RVUs, and margin for a trauma and critical care surgery group. Surgeons at that center who did not augment their emergency practice

with an elective practice generated far fewer charges, RVUs, and collections. They attributed these findings to the large proportion of unfunded and government care in the trauma/emergency surgery group, highlighting the fact that practice type and payer mix affect ACS financial viability.[12]

Other reported ACS models may be more financially viable. Alexander *et al*[21] examined factors contributing to hospital as well as faculty financial margin. In a major academic medical center with an active emergency surgery practice as part of an ACS model, injury care remained the foundation for both hospital and surgeon reimbursement.[21] Despite only 12% of cases being procedural, revenue from trauma victims was the major driver of hospital net revenue, per patient net revenue, and divisional (faculty) productivity. In that ACS group, 23% of the total productivity was EGS-based, although many cases were non-operative (42%). Elective surgery, although profitable, generated the lowest hospital margin, probably because the Diagnosis Related Groups (DRGs) associated with those procedures were not as high-paying, but the cases required significant operating room resources/cost. Thus trauma is profitable in this practice because of a high prevalence of commercial insurance. EGS is profitable with its high DRGs and prevalence of Medicare beneficiaries. But elective surgery has a lower revenue/cost ratio for the hospital. Considering demographics, payer mix, and the interests and skills of the ACS surgeons, a partnership between hospital and the physician practice can allow strategic development for mutual benefit.

The University of North Carolina trauma group examined the financial implications of ACS considering surgeon reimbursement based entirely on professional billing and how that might affect the ability of a department to support ACS surgeon salaries. They reported a 25% increase in procedural volume and RVUs but a coinciding increase in uncompensated care that was disproportionately higher than the remainder of the department. This group concluded that rather than supporting ACS salaries purely on RVU generation, an ACS model would require a differential payment model due to the large amount of uncompensated care in that particular health system.[13]

Impact of an ACS service on an organization can be measured beyond the impact of hospital revenue and revenue for the ACS surgeons. The Wake Forest University reported the overall positive impact of implementing an ACS service.[22] The non-ACS surgeons saw elective cases increase from 70% to 92% of their practice. RVUs went down for the elective surgeons, but because self-pay was nearly eliminated and government insurance reduced dramatically, the non-ACS surgeons saw a significant increase in compensation. The University of Missouri reported similar results when deploying the ACS brand as part of a coverage model in which trauma surgeons began covering most EGS consultations. Work RVU productivity increased 94% and operative volume increased 60%. Non-trauma surgeons saw half the RVUs in the emergency portion of their practice, but with increased elective volume the net was only a 9% decrease overall. When surveyed, all surgeons supported the new model and agreed that practice in an environment with an ACS service is preferable, permitting a more focused practice.[23]

Impact on revenue from surgical versus procedural workload

ACS practice today is very different from traditional trauma practice and continues to change. Austin *et al*[24] evaluated whether creation of an EGS service would increase operative case volume. Despite the fact that operative trauma cases declined during their study period, overall operative cases for the group increased by 15% per year during a 3-year period, suggesting that the addition of EGS can maintain or increase operative cases even in the face of decreasing operative trauma volume.[24]

Types of operations performed by ACS surgeons have also changed. From 2005 to 2008, trauma surgeons transitioned to performing more than half of the appendectomies and about half of the cholecystectomies in academic medical centers.[25] Cholecystectomy, appendectomy, and debridement were among the top 10 most commonly performed procedures by trauma surgeons, and cholecystectomy and appendectomy are among the top 5 most valuable in terms of RVU generation.[26] ACS surgeons now perform more procedures outside the operating room and at bedside, such as central venous catheterization, thoracostomy, wound care, and tracheostomy.[25]

Impact on revenue from cognitive work: evaluation and management including critical care

The financial success of ACS services has been dependent on cognitive work (evaluation and management including critical care services) in addition to procedural work (procedures and operations). Critical care, specifically the first hour (billed as Current Procedural Terminology (CPT) 99291), is the single most important contributor to ACS surgeon's clinical productivity, comprising an average of 25% of the total productivity for surgeons studied. Pottenger *et al*[26] reviewed the University Health Systems Consortium database during a 5-year period ending in 2012, and noted that 58% of work-related RVUs were derived from cognitive work. Ciesla *et al*[27] similarly reported that about half of all RVUs were from evaluation and management (E&M), and 63% of that E&M billing was from the ICU. They reported stable overall RVU productivity after implementation of the ACS service with a relative increase in procedure RVUs from 51% to 55%. In an analysis of over 60 000 academic physicians, E&M constituted more than half of the practice of surgeons characterized as trauma surgeons (55%), with surgical oncology the next highest at 35%.[25]

ACS workforce

The number of surgeons trained in our nation's graduate medical education system has remained stable for more than 20 years as the growth of the US population has far outpaced the supply of general surgeons. Between 1981 and 2006, the US population grew 31%, whereas the number of general surgeons grew by 4%.[28] A 35% increase in surgeons will be necessary to meet clinical demands by 2025, including roughly 25 200 to 33 200 surgical specialists.[29] Inadequate access to care for the American people is predicted to result from a shortage of general surgeons.[30] An aging surgical workforce and increasing surgical subspecialization have compounded these shortages.[31 32]

Emergency call coverage is also noticeably insufficient.[33] The Institute of Medicine highlighted this crisis in a report entitled "Hospital Based Emergency Care at the Breaking Point."[32] A survey conducted by the American College of Emergency Physicians in 2005 demonstrated that nearly 75% of emergency department medical directors believed that they had inadequate on-call surgical specialist coverage, up from 66% the year prior.[34]

In addition to a growing deficit in the number of trained surgeons, maldistribution of the surgical workforce relative to surgical care needs further reduces access to surgical care. Between 2006 and 2011, 155 rural counties and 38 urban counties experienced a drop in general surgery coverage. Another 898 or 29% of the approximately 3000 total counties in 48 states do not have a general surgeon.[35] As urban hospitals have a socioeconomic

advantage in hiring, surgical care in rural areas is at risk.[36] These disparities in access to care have been described as "surgical deserts."[37]

An aging surgical workforce is compounding these shortages.[33] As of 2013, 44.5% of general surgeons were aged 55 or older, compared with only 41% of internal medicine physicians. Changes in the field of surgery, including decreased reimbursement, administrative oversight with ever-changing rules, and the lack of professional liability reform, make early retirement more attractive.[38]

Increased subspecialization has amplified the shortage of emergency surgical coverage. With increased specialization, there are fewer surgeons who are trained in and maintain the broad skill set required to cover emergency department call for general surgery conditions. Almost 80% of general surgery residents finishing programs approved by the Accreditation Council for Graduate Medical Education (ACGME) pursue fellowships and become specialists.[28] A study by Yeo *et al*[39] reported that residents believed fellowship training to be necessary for them to be successful, competitive, and to have a better lifestyle and income. As the current cohort of older general surgeons retire, the reduced proportion of surgeons who are generalists will similarly decrease, amplifying shortages.

Recruitment into the field of trauma and critical care surgery was traditionally poor, as demonstrated by the fact that approximately 18% of fellowship positions were unfilled in 2011. In 2015, this had improved and only 10% of positions went unfilled.[40] Furthermore, in 2008, the first ACS fellowship approved by the American Association for the Surgery of Trauma (AAST) started. The goal of training ACS surgeons is demonstrated mastery in the field of ACS, above and beyond that learned in a general surgery residency. The standard training paradigm includes 1 year of an ACGME-approved critical care fellowship, followed by a second year of non-ACGME, AAST-sponsored ACS training. Graduates of these programs are highly sought after by academic and non-academic level 1 and 2 trauma centers as the training appropriately prepares graduates for the work required by their centers. Those trained in the ACS fellowships are eligible for board certification in surgical critical care through the American Board of Surgery. Added certification in ACS is currently offered through the AAST. Currently there are 20 approved ACS fellowship programs. Unlike most specialty training, this paradigm strives to create a broad-based surgical specialist, specifically trained in the treatment of acute surgical disease across a wide array of anatomic regions.[41] To date, over 100 fellows have been trained, again augmenting but not completely addressing the needs of patients with surgical emergencies. In 2012, Coleman *et al*[42] surveyed residents regarding a career path in ACS and discovered a growing interest and understanding of ACS as a career.

Other training paradigms to address the shortage of surgeons needed to provide EGS coverage include the American College of Surgeons Transition to Practice training paradigm.[43] This paradigm aligns recent residency graduates with more senior surgeons often in more rural environments in a mentor–mentee relationship. This allows the junior surgeon to become comfortable with complex surgical care delivery knowing that they are supported by more experienced providers. Although Transition to Practice trainees may help address some of the surgeon shortage, since they lack training in surgical critical care they may better serve the needs of rural America, where trauma centers and referral academic medical centers are few.[44]

Development of an ACS workforce depends not just on financial viability of the practice model itself, but whether surgeons can be attracted to the specialty with regard to salary. To determine the value of a career in ACS, Sweeting *et al*[13] performed a net present value (NPV) analysis. NPV is a standard business methodology commonly used to assess long-term investments. In their analysis, the authors considered years of training including a 2-year fellowship and the limited RVU capture associated with the payer mix of ACS. They determined that if a career in ACS were a "long term investment," salaries would need to be 28% higher in ACS to overcome the cost of training combined with a worse payer mix, to realize comparable long-term financial wealth as general surgery.[13] This interesting analysis lends support to the idea that for ACS practices to be successful, they may need to partner with healthcare organizations and share in hospital revenue.

ACS workforce stability also depends on retention. Unfortunately, burn-out and well-being of general surgeons and critical care providers are among the worst of all medical specialties.[45] Many of the components of an ACS practice place physicians at risk of burn-out. A survey of the members of the American College of Surgeons in 2008 showed that factors independently associated with burn-out included younger age, having children, area of specialization (trauma surgeons were more commonly affected), number of nights on call per week, work–home conflicts, and compensation based entirely on billing.[46] However, recent data measuring satisfaction among providers who consider themselves acute care surgeons are more encouraging, as surgeon satisfaction with the ACS model appears to be high.[18 23]

SUMMARY

About a quarter of US healthcare spending is on ACS diagnoses. As the population ages, the ACS patient population will grow. Changes in how healthcare is funded, and the ways in which organizations and surgeons align will dramatically affect the practice and lifestyle of the ACS provider. ACS surgeons are already doing less procedure work and more E&M than other surgeons. But ACS surgeons are in a pivotal position as stakeholders in US healthcare because of the size of the ACS patient pool, the broad range of diagnoses, and the high-reimbursing DRGs in many of our patients. Prepared with an understanding of ACS economics, surgeons can strategically partner with organizations to develop clinical programs that provide quality, efficient, high-value healthcare to patients and organizations, while creating rewarding professional practices for individual surgeons.

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